Core Engineering Competencies

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Competency A – Apply engineering knowledge, methods and techniques

Engineers are problem solvers. This competency is about solving engineering problems in a systematic way. Engineers define, analyze, and investigate problems so that solutions can be developed, tested and verified. This process is applied to all engineering problems. An "engineering problem" is any challenge that you are faced with that makes you apply your knowledge of engineering principles. When you answer questions like "How do we fix this process?" "How do we make a better product?" "How do we design this component?" you are applying engineering knowledge.

As you approach a project and define the problem, you analyze all relevant data to make sure that you fully understand the issues. Typically there are several possible solutions, but by evaluating them you narrow it down to the preferred one. The solution is developed and tested to make sure that it does satisfy all the original requirements. A key component of this process is evaluating and verifying that the solution interacts as it was intended in the environment for which it was designed.

To demonstrate this competency, think of an engineering challenge that you have faced, and describe how you solved it. What did you do? How did you do it? Why did you do it?

A. Apply engineering knowledge, methods and techniques
Definition
Solves engineering problems using appropriate theoretical and practical engineering principles.
Indicators
A1. Defines the engineering problem to be solved.
A2. Analyses relevant data.
A3. Identifies alternate solutions based on feasibility, technology and economic assessments.
A4. Develops the solution that best meets system requirements and specifications.
A5. Tests the solution to verify that it meets system requirements and specifications.
A6. Evaluates and verifies the practicality and effectiveness of the engineering solution in the environment for which it was designed.

Competency B – Use engineering tools, equipment or technology

Engineers use the right tool for the job. This competency is about demonstrating that you can use appropriate engineering tools, equipment and technology to solve engineering problems. These include everything from software to earth-moving equipment; from measuring devices to data analyzers, in other words, the engineering tools, equipment and technology that are used in your field of practice. You may use these engineering tools, equipment and technology yourself, or you may supervise their use by others.

For this competency we are not interested in the analysis or solution to the problem, we are interested in ***what*** you used to solve the problem and how and why you picked those particular tools, equipment or technology over all the available ones. You need to understand the underlying principles behind the tools, equipment or technology that you use, even if you are using a standard one, and provide reasons for selecting them. You need to be able to use what is relevant in your field. It is very important to detail the evaluation that you did before you used the tool, equipment or technology. Detail what you did to check that it was reliable, effective or appropriate for the application, and what you did to check that you were using it within its operating limits. Finally, you need to be able to check that the tool, equipment or technology that you used gave you a reasonable and valid result.

To demonstrate this competency, think of the engineering tools, equipment and technology that you have used and tell us why you used *those ones*, how you selected them, and what you did to apply them in the solution of engineering problems.

B. Use engineering tools, equipment or technology	
Definition	
Uses appropriate engineering tools, equipment or technology based on a sound understanding of engineering principles.	
Indicators	
B1.	Evaluates the reliability, effectiveness and limitations of available tools, equipment or technology for solving engineering problems.
B2.	Selects the appropriate tool, equipment or technology to solve engineering problems.
B3.	Uses, or directs the use of, the appropriate tool, equipment or technology to solve engineering problems.
B4.	Verifies that the tool, equipment or technology gave a valid result.

Competency C – Protect the public interest

Engineers protect the public. This is the primary duty of engineers, and the reason that the practice of professional engineering is regulated. Protecting the public interest is about more than just adhering to legislation, regulation, codes, standards and following the law. It also involves being aware of the risks inherent in engineering work, and of the short- and long-term impacts of engineering activities.

Whether you are working on a job site, or creating new designs, keeping the public safe is an engineer's professional responsibility. When we talk about the public, we mean anyone who could be affected by your engineering work: your colleagues, yourself, the people who build your products, the people who use your products, and the people who are affected by your products. No matter who you are, or what your position is, when you identify safety concerns it is your responsibility to speak out and take action: you might design a redundancy, change a work procedure, or stop unsafe work.

Engineers must also understand the risks and the short- and long-term impacts inherent to engineering activities, and they must take action to assess, inform, address and mitigate those risks and impacts. These impacts could be environmental, economic, social or issues of sustainability. Consider how your work will impact the physical environment. Which members of society stand to gain or lose from this work? Will your work be sustainable? Will it provide benefits or harm the economy it operates in? Assess those impacts, employing expertise as appropriate, and make sure that decision-makers know what you know. Do others in your field recognize these same impacts?

To demonstrate this competency, think of the engineering work that you do and its safety, risks and impacts – both positive and negative. Tell us what you have done to hold paramount the health, safety and welfare of the public, how you did it, and why you did it. Tell us about the risks and impacts of the engineering work that you have been involved in: what were they? How did you consider them? And why did you do that?

C. Protect the public interest	
Definition	
Practises engineering while safeguarding life, health, property, economic interests, and the environment, with an awareness of the risks and impacts of engineering work.	
Indicators	
C1.	Adheres to all applicable legislation, regulations, codes, and standards.
C2.	Identifies the impacts of engineering activities, both positive and negative.
C3.	Ensures that the positive and negative impacts of engineering activities are assessed.
C4.	Assesses safety concerns and risks of engineering activities to identify hazards and potential harm.
C5.	Takes action to address safety concerns and mitigate risks.
C6.	Shares results of assessments with decision-makers.

Competency D – Manage engineering activities

Engineers manage work effectively. For any engineering undertaking that you are assigned, you need to organize and plan how to get the work done before you start it. This can be demonstrated through managing your own engineering work, managing engineering teams, or managing engineering projects. To do this, you have to identify what work is required, what resources are available (other people? money? materials?), and what the limitations are (deadlines? budget?). Having identified these constraints, you can plan how to do the work. You document that plan as a "work plan" – something that explains who will get what done by when, using what resources.

Scope, schedule and budget are examples of common elements of engineering work that need to be monitored and managed by engineers. While you are executing the plan, things can change: budgets may increase or decrease, people may be hired or leave, workloads may increase unexpectedly. You are always looking out for any of these changes that would pose a risk to completing the work, and planning how to manage those risks. To properly manage your projects, you need to adjust your plan, documenting the reasons for changes, and making sure that you can still deliver. Finally you keep stakeholders informed so that they can adjust as necessary as well.

To demonstrate this competency, think about the work that you are responsible for. How did you plan, organize and manage it, keeping records and people informed. What actions did you take and why did you take them?

D. Manage engineering activities	
Definition	
Plans and organizes engineering activities, monitors progress, and makes adjustments to complete work within constraints.	
Indicators	
D1.	Seeks clarity of the assigned activities, including identification of constraints such as time, resources, quality or budget.
D2.	Develops a work plan to complete work within identified constraints.
D3.	Adjusts work plan to respond to changing circumstances that could pose a risk to completing assigned activities.
D4.	Keeps stakeholders informed of progress, obstacles and changes to the work plan.
D5.	Keeps records of engineering work and decisions.

Competency E – Communicate engineering information

Engineers are communicators. No matter what kind of engineering work you do, you must be able to clearly communicate engineering information to get that work done. Communication is more than just telling. It also involves active listening – making sure that you fully understand others and that they fully understand you. The audience that you communicate with could be your boss, your clients, your colleagues, your direct-reports or even the public. The ways that you communicate include graphically (such as drawings, sketches, schematics, flow diagrams, or 3-D models), in writing (such as mail, email, or reports) and verbally (such as presentations, meetings, or phone conversations).

The first step is to know your audience and make sure your message is tailored to their knowledge and needs. After delivering any message, you ensure that the audience understands with question and answer. You respond to questions and their input in the same way, checking that you understand what the audience is asking before responding.

To demonstrate this competency, think about a time that you communicated or received engineering information. Who was the audience? How did you communicate? How did you make sure that they understood you, and that you understood them?

E. Communicate engineering information	
Definition	
Effectively communicates engineering information verbally, graphically and in writing	
Indicators	
E1.	Tailors communications to the audience.
E2.	Communicates engineering information graphically (formal or informal).
E3.	Communicates engineering information in writing.
E4.	Communications engineering information verbally.
E5.	Uses two-way communication to verify own understanding and the understanding of the intended audience.

Note: Applicants who do not communicate verbally due to a disability would demonstrate "verbal" communication through another interactive form of communication (i.e. sign, voice output communication aids, etc.)

Competency F – Work collaboratively in a Canadian environment

Engineers work in teams. Most engineering work in Canada involves teams, and engineers must be able to work with diverse teams. These teams can include formal teams such as project teams, or informal ones such as the team of client, engineer and end-user. The diversity of Canadian teams can include but is not limited to people of different professions, educational backgrounds, genders, levels of seniority in the organization, languages, cultures, etc. Engineers must be able to work professionally with everyone regardless of their expertise, background or title.

The first step in good teamwork is to be willing to share information and expertise with your team members, and to be willing to use the input from them as well. In order for the team to work towards a common goal, you must be able to agree on the goals and the best way to achieve them. As the team works towards its goals, you support each other, and recognize each others' contributions.

All examples for this competency must be demonstrated in a Canadian environment. To demonstrate this competency, think about a time when you worked with a team. Tell us what you did with the team, why you took the actions you did, and how you worked as a team to achieve the project goals.

F. Work collaboratively in a Canadian environment
Definition
Practises engineering in a Canadian environment to achieve organizational and project goals in a collaborative manner.
Indicators
F1. Shares information, knowledge and expertise with others.
F2. Assists other team members when needed.
F3. Considers the input of colleagues at all levels.
F4. Builds consensus among team members.

Competency G – Maintain and enhance engineering skills and knowledge

Engineers keep their skills current. Every day brings new challenges, new technologies, and advances in knowledge that you need to incorporate into your engineering practice. As you develop and seek out new challenges, you need new knowledge, skills and abilities to practise competently and to be successful. The first step is to identify any gaps or learning needs. You may have been asked to do something new, or you may need to learn more to enhance your engineering capabilities. Through activities like self-study, professional readings, experiential learning, coaching, mentoring or even courses, seminars, or conferences, you continue to learn throughout your career.

To demonstrate this competency, think about the new knowledge, skills and abilities you have acquired and why you sought those out. Tell us what you've done to stay current and knowledgeable in your field. Tell us about a time that you realized you needed to learn more, and how you did it. Any learning that was required for you to perform better in your job can be included here, but you must explain how it relates to your engineering work.

G. Maintain and enhance engineering skills and knowledge
Definition
Takes actions to maintain and enhance proficiency in the practice of engineering activities.
Indicators
G1. Takes action to address gaps in knowledge, skills and abilities.
G2. Keeps current with the dynamic nature of engineering.